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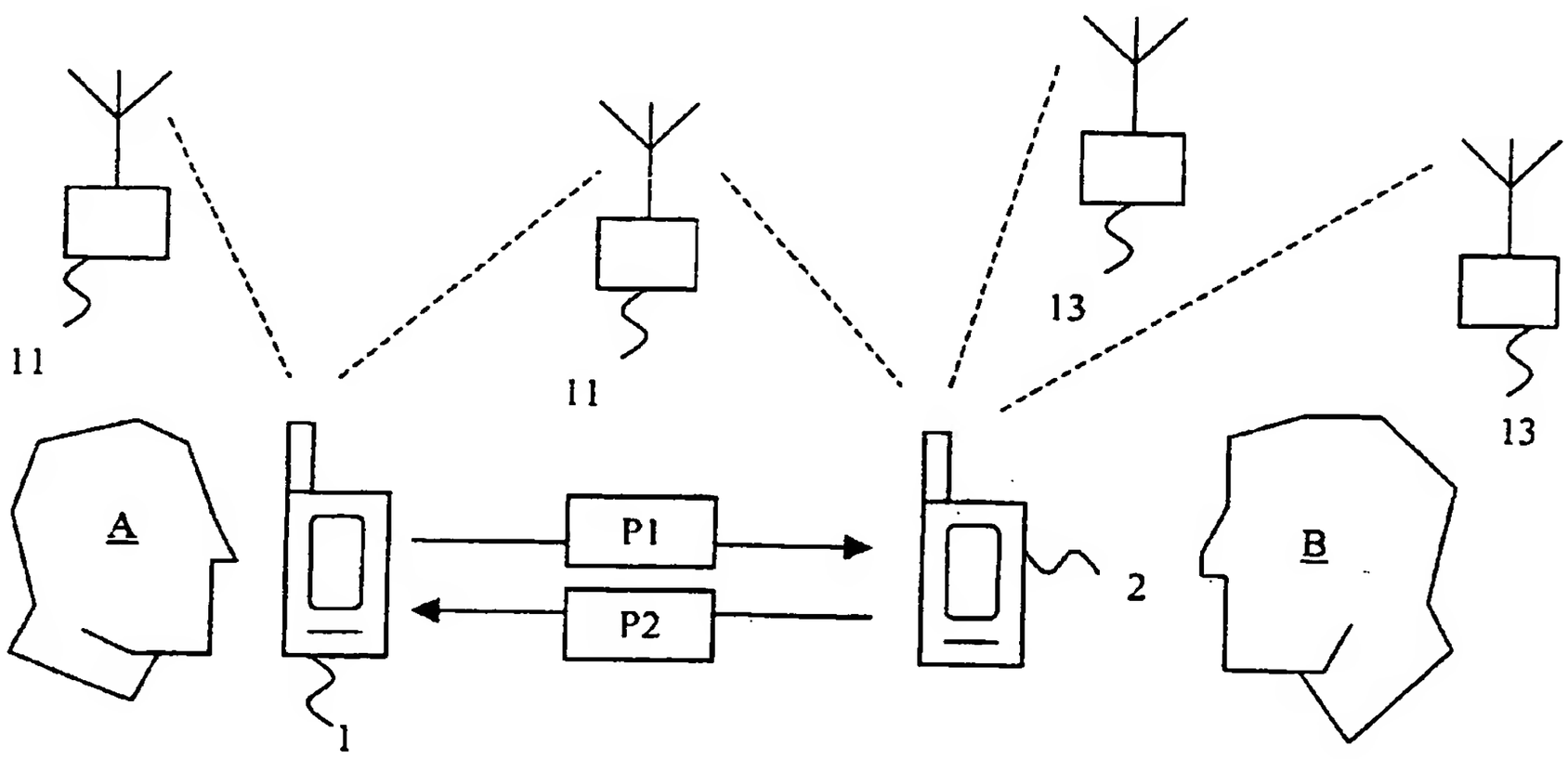
(54) Title: DEVICES AND METHODS FOR POSITIONING MOBILE COMMUNICATION UNITS



(57) Abstract: Devices and methods for positioning mobile communication units. One system solution comprises a first (1) and a second (2) communication unit, whereby each communication unit (1, 2) comprises a means (3) of wireless short-range communication, and a means (4) for wireless long-range communication with positioning facilities (10, 11). The said first communication unit (1) comprises a means (5) for calculating a position (P) depending on first positioning information (P1) of a certain type, obtained from a first positioning facility (10, 11), and second positioning information (P2) of the same type, obtained by short-range communication from the said second communication unit (2). The said positioning facility can be, for example, a satellite in a GPS system or a base station in a cellular radio communication system.

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DEVICES AND METHODS FOR POSITIONING MOBILE COMMUNICATION UNITS

TECHNICAL AREA

The present invention concerns systems and procedures for providing positioning information in mobile communication units. To be more precise, a solution is concerned for the collaborative positioning with the aid of short-range communication between positioning communication units, whereby one communication unit exploits positioning information from a number of communication units and combines the information in an advantageous manner such that resulting positioning information with improved precision is obtained.

INTRODUCTION

The use of mobile communication units has increased strongly during the past ten years. It may be said that the expression "mobile communication unit" previously included mainly only personal pagers. The mobile telephone was subsequently introduced with communication in cellular radio networks. Mobile telephones are tending to become more advanced as the development of technology allows higher battery capacity and smaller components, whereby the handsets can be made smaller while the range of services and functions offered becomes greater. The introduction of GPRS, General Packet Radio Services, and the building in the future of what is known as the third generation of mobile telephone systems, and the subsequent network systems, will allow the speed of data transmission to increase significantly over the circuit-connected systems of today, of the GSM, Global System for Mobile Communications, type. This will open the way for what is popularly known as wireless Internet, and it is expected, among other things, to make possible more advanced services that, for example, involve the transmission of moving images. This will also pose greater demands on the mobile terminals, or communication units, with respect to, for example, memory and display. At the same time, the boundary between what is a mobile telephone and what is a small computer will become less clear. Pocket computers or hand computers, also known as PDAs, Personal Digital Assistants, are currently available that include the technology required for communication over cellular networks.

The preliminary launch of the mobile Internet that has been achieved through WAP, Wireless Application Protocol, has led to the realisation by those providing services, known as Service Providers (SPs), of the significance of being able to offer services that depend on position. A typical example of such a service is a mobile restaurant guide. A client contacts a restaurant guide site and requests

information about restaurants in the neighbourhood. The SP determines the current position of the client's communication unit, collects information about restaurants in the vicinity of the determined position and provides the client with relevant information, such as directions, specialities and prices, about the restaurants.

One problem is that existing positioning methods have different weaknesses, which means that the precision of the positioning in certain cases is poorer than that desired or expected, and occasionally the positioning can be, quite simply, impossible to carry out. One method of obtaining position information from an arbitrary position is to exploit signals from satellites. GPS, Global Positioning System, is a positioning system in which a GPS receiver can receive signals from a network of satellites, and calculate its position to a certain precision with the aid of these signals. The main problem with GPS is that of being able to see sufficiently many satellites. This may be a problem in urban environments with tall buildings (known as urban canyons), under bridges and under extensive leaf cover. Indoor positioning using GPS is a difficult problem to solve.

Another method of obtaining positioning information is to exploit signals from base stations in cellular communication networks, such as the GSM network. This method is known as cellular positioning. Some examples of existing solutions are TOA, Time of Arrival; TDOA, Time Difference of Arrival; AOA, Angle of Arrival and E-OTD, Enhanced Observed Time Difference. Various obstacles, such as those found in an urban environment, can in the various methods that are based on cellular positioning make the wave distribution complex and dependent on the exact position of the mobile unit. This is a result of, among other effects, what is known as multipath, diffraction or the insufficiency of the link budget for enabling the mobile unit to hear or be heard by sufficiently many base stations. This in turn leads to problems with the positioning. The problems vary considerably with the exact position – a problem experienced at one point can very well be considerably less or different at a point that lies only a few metres away.

WO 0/75682 presents a technique for obtaining positioning information from different positioning services. Furthermore, various operating properties, such as availability, cost, speed, power consumption and quality of positioning information, are obtained from these services. A mobile unit equipped with means of realising the technique is further arranged to select positioning information from at least one of the positioning services used, based on the said operating properties.

THE AIM OF THE INVENTION

Mobile positioning offers tremendous opportunities for creating interesting services that can benefit the user, but these services cannot at the moment be built or used to their full extent due to the fact that existing positioning solutions suffer from

disadvantages. GPS suffers from a disadvantage with respect to price and size, which means that the telephone manufacturers hesitate from incorporating the technology into normal mobile telephones. Furthermore, accessibility for signals can be a problem in certain situations. The problem with cellular positioning is mainly that the precision is seriously limited, as a rule to no better than a few hundred metres. The aim of the present invention, thus, is to provide a solution for the positioning of mobile communication units that displays advantages with respect to the prior art.

SUMMARY OF THE INVENTION

According to a first aspect, therefore, the present invention concerns a system for the positioning of mobile communication units, comprising a first and a second communication unit, whereby each communication unit comprises a means of wireless short-range communication, and a means for wireless long-range communication with positioning facilities. The said first communication unit comprises a means for calculating a position depending on first positioning information of a certain type, obtained from a first positioning facility, and from second positioning information of the same type, obtained by short-range communication from the said second communication unit.

According to a second aspect, the invention concerns a communication unit with positioning functionality, comprising a means of wireless short-range communication, and a means for wireless long-range communication with a first positioning facility. The communication unit further comprises a means for calculating a position depending on first positioning information of a certain type, obtained from the said first positioning facility, and from second positioning information of the same type, obtained from another source via the said means of wireless short-range communication.

It is preferabie that the said second positioning information comprises information from a second positioning facility, and that the said means for calculating a position is, in one embodiment, arranged to combine the said first positioning information with the said second positioning information in order to calculate the said position.

In one embodiment, the said means for wireless long-range communication is a GPS receiver, and the said positioning facilities are GPS satellites, whereby the said positioning information is GPS signals. In this way, the said first positioning information and the said second positioning information comprise GPS signal information from different GPS satellites, whereby the said position is calculated depending on the total set of signals from these GPS satellites.

In a second embodiment, the said positioning facilities are a base station in a cellular communication network, whereby the said first positioning information and the said second positioning information comprise signals from different base stations, and the said position is calculated depending on the total set of signals from these different base stations.

According to a third aspect, the invention concerns a method for the positioning of a communication unit, comprising the steps of collecting first positioning information for the said communication unit from a first source, and second positioning information from a second source, which first and second positioning information are of the same type, and calculating a position depending on the total set of both the first and the second collected positioning information. It is preferable that the said first positioning information is collected via wireless long-range communication directly from a positioning facility, and it is preferable that the said second positioning information is collected via wireless short-range communication from a second communication unit. In an alternative embodiment, both the said first and the said second positioning information are collected via wireless short-range communication from other communication units.

According to a fourth aspect, the invention concerns a method for the positioning of a communication unit, comprising the steps of detecting a first positioning signal from long-range communication between a first communication unit and a first positioning facility, detecting a second positioning signal from long-range communication between a second communication unit and a second positioning facility; uniting the first positioning information based on the said first positioning signal with the said second positioning information based on the second positioning signal via short-range communication; and calculating a position based on both the said first and the said second positioning information, with a positioning precision defined by the range of the short-range communication.

In one embodiment, the said short-range communication takes place between the said communication units, whereby the positioning information is united and the position is calculated in at least one of these. In a second embodiment, the said short-range communication takes place between each of the said communication units and a third communication unit, in which the said positioning information is united and the position calculated. The said positioning facilities can, for example, be GPS satellites or base stations in a cellular radio communication system. In one embodiment, the said short-range communication takes place using Bluetooth.

In a second embodiment, the said positioning facilities are a base station in a cellular communication network, whereby the said first positioning information and the said second positioning information comprise signals from different base stations, and the said position is calculated depending on the total set of signals from these different base stations.

According to a third aspect, the invention concerns a method for the positioning of a communication unit, comprising the steps of collecting first positioning information for the said communication unit from a first source, and second positioning information from a second source, which first and second positioning information are of the same type, and calculating a position depending on the total set of both the first and the second collected positioning information. It is preferable that the said first positioning information is collected via wireless long-range communication directly from a positioning facility, and it is preferable that the said second positioning information is collected via wireless short-range communication from a second communication unit. In an alternative embodiment, both the said first and the said second positioning information are collected via wireless short-range communication from other communication units.

According to a fourth aspect, the invention concerns a method for the positioning of a communication unit, comprising the steps of detecting a first positioning signal from long-range communication between a first communication unit and a first positioning facility, detecting a second positioning signal from long-range communication between a second communication unit and a second positioning facility; uniting the first positioning information based on the said first positioning signal with the said second positioning information based on the second positioning signal via short-range communication; and calculating a position based on both the said first and the said second positioning information, with a positioning precision defined by the range of the short-range communication.

In one embodiment, the said short-range communication takes place between the said communication units, whereby the positioning information is united and the position is calculated in at least one of these. In a second embodiment, the said short-range communication takes place between each of the said communication units and a third communication unit, in which the said positioning information is united and the position calculated. The said positioning facilities can, for example, be GPS satellites or base stations in a cellular radio communication system. In one embodiment, the said short-range communication takes place using Bluetooth.

BRIEF DESCRIPTION OF THE DRAWINGS

Various examples of embodiments of the present invention are described below with simultaneous reference to the attached drawings, of which

Fig. 1 illustrates schematically one embodiment of the system according to the invention, realised in a satellite positioning system;

Fig. 2 illustrates schematically one embodiment of the system according to the invention, realised in a cellular radio communication system;

Fig. 3 illustrates schematically one embodiment of the system according to the invention, realised in a cellular radio communication system, with communication between three parties;

Fig. 4 illustrates schematically one embodiment of a communication unit according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention concerns, according to one aspect, a system for positioning of communication units, such as, for example, portable computers, PDAs or mobile telephones. This system makes it possible for closely located users to determine a position in collaboration with higher performance than each of them could have achieved on their own. The system uses short-range communication to aid a customer with a communication unit arranged to use a positioning service to find other communication units arranged to use positioning in the immediate vicinity, and to combine information from these communication units in order to determine a geographic position in collaboration. The said short-range communication can be realised using, for example, Bluetooth or IR, or using some other protocol and transmission medium that has a range that can be considered to be of the order of the precision that can be permitted for the positioning. The example of Bluetooth is expected to have a range of approximately 10 metres, while at the same time it is expected in certain cases to cope with up to 100 metres.

If we accept that the range of the short-range communication used is sufficiently low to give an acceptable positioning precision, the various communication units can be considered from the point of view of the system to be in approximately the same position. This is particularly true of the combination of cellular positioning, with a precision of approximately 100-200 metres, in the optimal case, and Bluetooth with a range of approximately 10 metres. By exploiting the ability of Bluetooth units to form piconetworks and scatter networks with a limited number of links, one can increase the range of the short-range communication in a controlled manner and remove the limitations of Line-Of-Sight, increasing the probability that communication units with positioning facilities of the correct type are within the range of the short-range communication. The description

below contains the phraseology that a user "sees" or "does not see" positioning facilities. However, this is not to be interpreted in any other manner than that the communication units of particular users can or cannot detect signals from the said positioning facilities.

Fig. 1 shows schematically one embodiment of the present invention in the case of satellite positioning using, for example, GPS. One user A has a communication unit 1, such as, for example, a PDA, equipped with a receiver of satellite signals. However, the satellite signal receiver can only see, in the position in which it is located, two satellites 10, and this is not sufficient to determine the position of the person A, or to be more accurate, the communication unit 1. The two satellite signals that are detected form the first positioning information P1, which can be seen as a subset that can be used to calculate the current position P. Detection of a satellite signal is indicated in the drawing by a dashed line. The user A can subsequently establish short-range communication, indicated in the drawing by a solid arrow with filled arrow-head, with another user B who also has a communication unit 2 equipped with a satellite receiver. This unit 2 has free view of three satellites, 10, 12, but at least one or several 12 that the first user A cannot see. The signals from the three satellites that are recorded by the communication unit of the user B form the second positioning information P2. By combining information P1, P2 from the two customers A, B, a good determination of position can be made by these two together since they together can see five satellites, of which four might be sufficient. Note that a subset, such as, for example, P2, may very well be sufficient to determine the position, but the subset may, despite this, be useful in order to supplement signals in the other subset P1 such that the communication unit 1 that is associated with it can carry out the calculations required to obtain the position P.

As has been illustrated, the users can transmit positioning information P1 and P2 to each other, such that they each can exploit P1 and P2 in order to calculate the position P. One possible alternative scenario is to send only one set of positioning information, P1 for example, from A to B, and for the calculation of P to be carried out only in the communication unit 2 of this user. In this case, B answers A by transmitting the position P to the latter's communication unit. This may be advantageous if B has a powerful communication unit 2, such as, for example, a portable computer, while A has the simplest possible equipment 1, which does not permit advanced calculations.

A second embodiment is shown schematically in Figure 2, in which the positioning is carried out on the basis of signals to or from base stations 11, 13 in a cellular radio communication system. The base stations in this case constitute positioning facilities. It may be the case that the users A and B individually cannot

hear or be heard by sufficiently many base stations in order to be able to carry out a determination of position, while together they may be. Both A and B may have problems distinguishing the signal that has been transmitted directly from all reflected signals. By combining the measurements from A and B using, for example, a maximum likelihood method, the probability of distinguishing the correct signal can be increased. The precision of the measurement can be further increased by making a number of observations over a period of time. In order to obtain high precision, the following condition must be fulfilled, T*D >> 1, where T is the observation time and D is the signal bandwidth. By being able to observe more than one user, the observation time is increased by a factor that may be 2, 3 or higher, depending on how many users are sufficiently close for collaboration to be possible.

The communication unit of the user A has free sight to two base stations 11 in the scenario shown in Fig. 2. The signals from the two detected base stations 11 form the positioning information P1, which is not sufficient to determine the position. User B, on the other hand, can detect three base stations, 11, 13, of which at least one 13 cannot be seen by user A. The signals from the base stations that B detects form the positioning information P2. In the same way as has been described above for the case using satellite positioning, A can in this case exploit positioning information P2 from B in order to calculate the position P with the use of the total set of both P1 and P2, with the assumption that both P1 and P2 have been detected at the same point. In the case of cellular positioning it is, of course, also possible to both exploit positioning information P1, P2, and for a user A to provide positioning information P1 for a user B, and to receive in return a calculated position P.

The collaboration between two communication units equipped with positioning has been described in the examples above. Naturally, it is not a limitation that only two units participate. It can in certain cases be better to use more communication units. Bluetooth allows the formation of piconetworks with up to eight participating communication units, and the formation of what are known as "scatter networks" with several links. This can be a great advantage if it is desired to obtain collaboration between more than two communication units. A further embodiment is shown schematically in Fig. 3, in which three users A, B, C are involved, each with a communication unit 1, 2, 6. The example in Fig. 3 shows positioning in a cellular radio network of the type that has been described in connection with Figure 2, although it can just as well be applied to the example according to Figure 1. Thus, the user A sees two base stations 11 and the user B sees three base stations 11, 13. A user C desires to determine his or her position, and thus obtains aid from the users A and B through a short-range communication. This short-range communication can take place directly with the two parties A and B, or it may go via one of them, which in the example shown is user B. According to the

present invention, the user C in this way obtains positioning information P1, P2 from two different sources 1, 2 that see different positioning facilities 11, 13, and the user C can thus calculate the position P with the aid of the collected positioning information P1, P2 in his or her communication unit 6. A method according to Fig. 3 can be used both if the user C alone or in combination with another user B detects sufficiently many positioning facilities 11, 13, and if the communication unit 6 is completely lacking in the capacity to detect signals from positioning facilities 11, 13. Furthermore, the communication unit 6, for example, may be equipped for GPS positioning while at the same time being equipped to receive positioning information P1, P2 from communication units 1, 2 equipped for cellular positioning that are in the vicinity, when the GPS coverage is insufficient, such as, for example, in tunnels with GSM coverage, or *vice versa*.

It is, however, true that the position P that is obtained does not actually reflect the position of user C, but an approximate position of a location that covers both user A and user B. Due to the fact that the range of the short-range communication is considerably shorter than the precision of the cellular positioning system, however, the approximation that P is the location of the user C can still be made. If the positioning system had been based on the use of satellites, which may have a precision of a few metres, then the fact that at least two communication units 1, 2 were used would, naturally, have contributed to reducing the precision. In one embodiment of the system according to the present invention, the total number of communication units 1, 2, 6 involved is calculated. This means not only the communication units 1, 2 that are used to detect the positioning information P1, P2, but also the communication units 6 that are used solely to communicate the positioning information. This total number, three in the example according to Fig. 3, is subsequently used in order to estimate the precision of the determination of position, according to a suitable mathematical method. It is preferable that the precision is presented for user C when the calculated position P is presented.

The technological realisation of the system can vary considerably, depending on the type of terminal and the positioning technology used. If the terminal, that is, if the communication unit, is a mobile telephone with Bluetooth, the application can be placed not only on the SIM card (the Subscriber Identification Module card) in order to control communication with the network, it can also exploit the ability of Bluetooth to find other communication units within the range of the short-range communication, extended, where relevant, by one or a few links in a scatter network. These other communication units can be defined with certain properties, for example, the communication unit must have a GPS receiver, or, to be more restrictive, the communication unit must have a GPS receiver and it must see a certain defined satellite.

Those parts that are more calculation-intensive for the combination of measurement data from several communication units and, where relevant, the combination with other techniques, such as those known as "map matching" such as ML estimation, Kalman filtering, etc., can be arranged on a server in a communication network. If the terminal is a PDA, a greater amount of the calculations can be carried out locally.

It may be necessary in certain cases to combine the technical realisation with one of the methods available for being able to provide economic compensation for the one who contributes positioning information. Possible solutions are based on some form of micropayments, for which a number of technical solutions are available, or they are based on some form of group membership with access control and, where relevant, a membership fee for the group. However, it is not obvious that an economic compensation mechanism is required, as is demonstrated by a number of Peer-to-Peer applications.

One method of exploiting the present invention is to depend on the probable development of the transport telematics area, where it is probable that a major part of all newly produced vehicles will, within a few years, be equipped with GPS receivers in order to be able to position the vehicle. It is not a problem in a vehicle that the GPS receiver consumes power, dead-reckoning and, where relevant, map matching are included in the system, and it will be possible to know the position of the vehicle at all times to within a precision of 5-10 metres. If the vehicle is also equipped with a means of short-range communication, such as Bluetooth, for communication with the surroundings, a large number of communication points with precisely determined positions and that are mobile within the terrain, thus creating a greater coverage, has rapidly been created. In this way, a system for precision positioning has been created in which it is possible to determine one's position accurately whenever one is located sufficiently close to a street or road. The interval during which it is necessary to wait until accurate positioning is available depends of the density of traffic on the street/road and on the fraction of vehicles that has the technical capacity for positioning and for communication of the position. By exploiting the ability of Bluetooth units to form piconetworks and scatter networks with a limited number of links, one can increase the range of the short-range communication in a controlled manner and in this way increase the corridor around the road in which accurate positioning is available.

Furthermore, a communication unit 1, which could just as well be the units 2 or 6, is shown highly schematically in Fig. 4. The communication unit 1 comprises, in addition to those attributes that make it possible for the user to use it, such as, buttons, monitor screen, software, etc., a controller 7. This controller controls the communication unit in those processes that are relevant for the present

invention, that is, offering or collecting positioning information and carrying out calculations of position. The controller preferably comprises a processor with the associated memory and software. In the case of a mobile telephone, the controller 7 can also comprise the SIM card.

The communication unit 1 also comprises a means 3 of wireless short-range communication. This means 3 may comprise a Bluetooth chip, or, for example, a means of IR communication. Furthermore, the communication unit 1 comprises a means 4 for long-range communication. This means 4 is, in a cellular embodiment the actual communication part, that is, the sender and receiver in a mobile telephone network, and it is connected to the aerial of the mobile telephone. In one alternative embodiment, in which the communication unit is a PDA 1 equipped for satellite positioning, the said means 4 is a receiver of satellite signals. Thus this means 4 is equipped for long-range communication with a positioning facility 10, 11, 12, 13, that is, for example, a satellite 10, 12 or a base station 11, 13, depending on the design. The controller 7 controls a calculator 5, arranged to calculate a position P depending on the positioning information P1, P2. It is preferable, furthermore, that a memory 8 is connected to the controller 7 for storage of positioning information P1, P2 and position information P.

The invention is thus characterised in that the positioning is based upon collaboration between at least two communication units in the vicinity of each other, in order to handle the weaknesses of various methods in certain situations. It is ensured that the communication units are located in the vicinity of each other, that is, that the position information obtained will be relevant with a certain imprecision, through the use of short-range communication with a limited range. Short-range communication at "zero mobile cost" can be exploited in order to exchange information such as positioning information P1, P2 or position information P between the different communication units. Traditional and established statistical methods, such as ML, Kalman filtering, etc., can be used in order to combine the information from several communication units.

The invention has been described mainly as intended for mobile communication units, since such units can be in different positions. However, this does not prevent one or more fixed communication units being exploited, possibly as a source or positioning information P1 or P2, or as part of a piconetwork or a scatter network, in order to position a mobile communication unit.

Different embodiments of the present invention have been described in the form of examples, but one skilled in the arts will realised simply by examining these examples that further variants can be conceived. Thus the invention is limited only by the attached claims.

CLAIMS

1. A system for positioning mobile communication units, c o m p r i s i n g a first (1) and a second (2) communication unit, whereby each communication unit (1, 2) comprises a means (3) for wireless short-range communication, and a means (4) for wireless long-range communication with positioning facilities (10, 11) , whereby the said first communication unit comprises a means (5) for calculating a position (P) depending on first positioning information (P1) of a certain type, obtained from a first positioning facility (10, 11), and second positioning information (P2) of the same type, obtained with short-range communication from the said second communication unit (2).

2. The system according to claim 1, in which the said second positioning information (P2) comprises information from a second positioning facility (12, 13), and in which the said means (5) for calculating a position (P) is arranged to combine the said first positioning information (P1) with the said second positioning information (P2) in order to calculate the said position (P).

3. The system according to claim 1, in which the said means (4) for wireless long-range communication is a GPS receiver, and the said positioning facilities (10, 12) are GPS satellites, whereby the said positioning information (P1, P2) is GPS signals.

4. The system according to claim 2 in combination with claim 3, in which the said first positioning information (P1) and the said second positioning information (P2) comprise GPS signal data from different GPS satellites, and in which the said position (P) is calculated depending on the complete set of signals from these different GPS satellites.

5. The system according to claim 1, in which the said positioning facility (11, 13) is a base station in a cellular communication network.

6. The system according to claim 5, in which the said first positioning information (P1) and the said second positioning information (P2) comprise signal data from different base stations, and in which the said position (P) is calculated depending on the complete set of signals from these different base stations.

7. A communication unit (1) with positioning functionality, comprising a means (3) for wireless short-range communication, a means (4) for wireless long-range communication with a first positioning facility (10, 11) , and a means (5) for

calculating a position (P) depending on first positioning information (P1) of a certain type, obtained from the said first positioning facility (10, 11), and second positioning information (P2) of the same type, obtained from another source via the said means (3) of wireless short-range communication.

8. The communication unit according to claim 1, in which the said second positioning information (P2) comprises information from a second positioning facility (12, 13), and in which the said means (5) for calculating a position (P) is arranged to combine the said first positioning information (P1) with the said second positioning information (P2) in order to calculate the said position (P).

9. The communication unit according to claim 7, in which the said means (4) for wireless long-range communication is a GPS receiver, and the said positioning facilities (10, 12) are GPS satellites, whereby the said positioning information (P1, P2) is GPS signals.

10. The communication unit according to claim 8 in combination with claim 9, in which the said first positioning information (P1) and the said second positioning information (P2) comprise GPS signals from different GPS satellites, and in which the said position (P) is calculated depending on the complete set of signals from these different GPS satellites.

11. The communication unit according to claim 7, in which the said positioning facility (11, 13) is a base station in a cellular communication network.

12. The communication unit according to claim 11, in which the said first positioning information (P1) and the said second positioning information (P2) comprise signal data from different base stations, and in which the said position (P) is calculated depending on the complete set of signals from these different base stations.

13. A method for the positioning of a communication unit (1), comprising the steps of:
- collecting first positioning information (P1) for the said communication unit (1) from a first source, and second positioning information (P2) from a second source, which first and second positioning information are of the same type, and
- calculating a position (P) depending on the total set of both the first (P1) and the second (P2) positioning information collected.

14. The method according to claim 13, in which the said second positioning information (P2) is collected via wireless short-range communication from a second communication unit (2).

15. The method according to claim 13 or 14, whereby the said first positioning information (P1) is collected via wireless long-range communication directly from a positioning facility.

16. The method according to claim 13, in which the said first positioning information (P1) and the said second positioning information (P2) are collected via wireless short-range communication from other communication units (2).

17. A method for the positioning of a communication unit, comprising the steps of:
- detecting a first positioning signal from long-range communication between a first communication unit (1) and a first positioning facility;
- detecting a second positioning signal from long-range communication between a second communication unit (2) and a second positioning facility;
- uniting the first positioning information (P1) based on the said first positioning signal with the said second positioning information (P2) based on the second positioning signal via short-range communication;
- calculating a position (P) based on both the said first and the said second positioning information, with a positioning precision defined by the range of the short-range communication.

18. The method according to claim 17, in which the said short-range communication takes place between the said communication units (1, 2), whereby the positioning information (P1, P2) is united and the position (P) calculated in at least one of the same.

19. The method according to claim 17, in which the said short-range communication takes place between each of the said communication units (1, 2) and a third communication unit (6), in which third communication unit (6) the said positioning information (P1, P2) is united and the position (P) calculated.

20. The method according to claim 17, in which the said positioning facilities are GPS satellites.

21. The method according to claim 17, in which the said positioning facilities are base stations in a cellular radio communication system.

22. The method according to claim 17, in which the said short-range communication take place using Bluetooth.

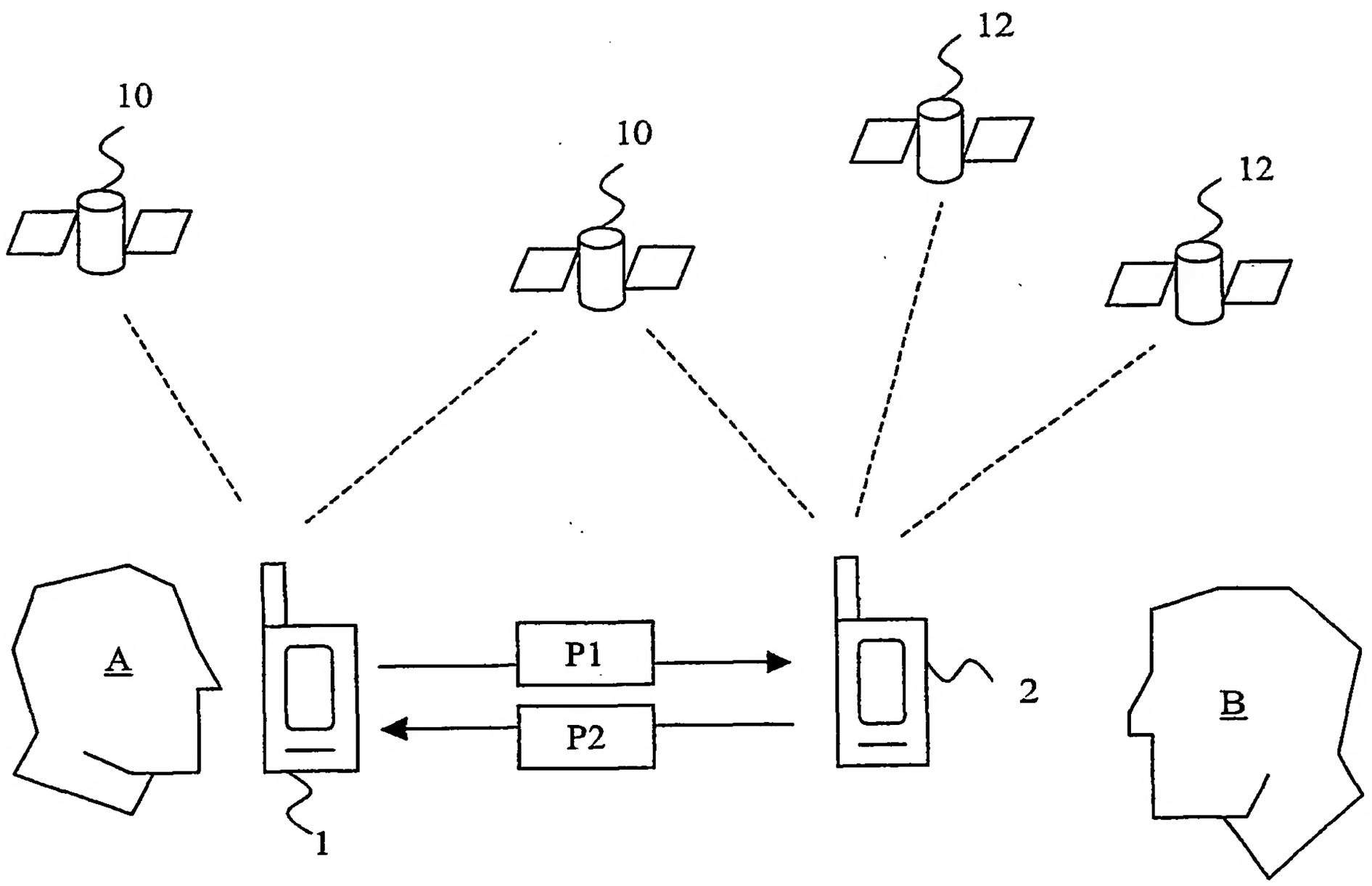

Fig. 1

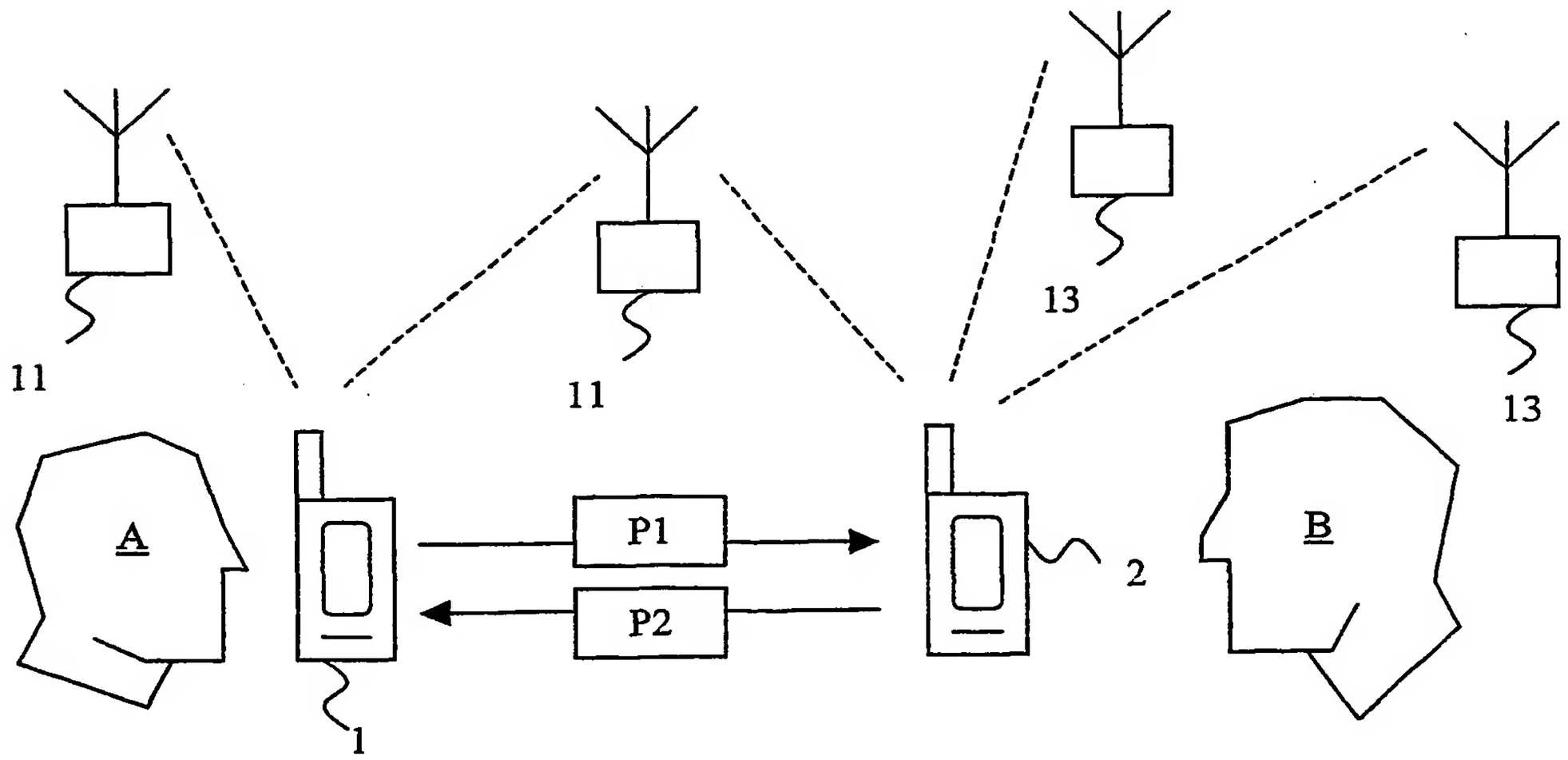

Fig. 2

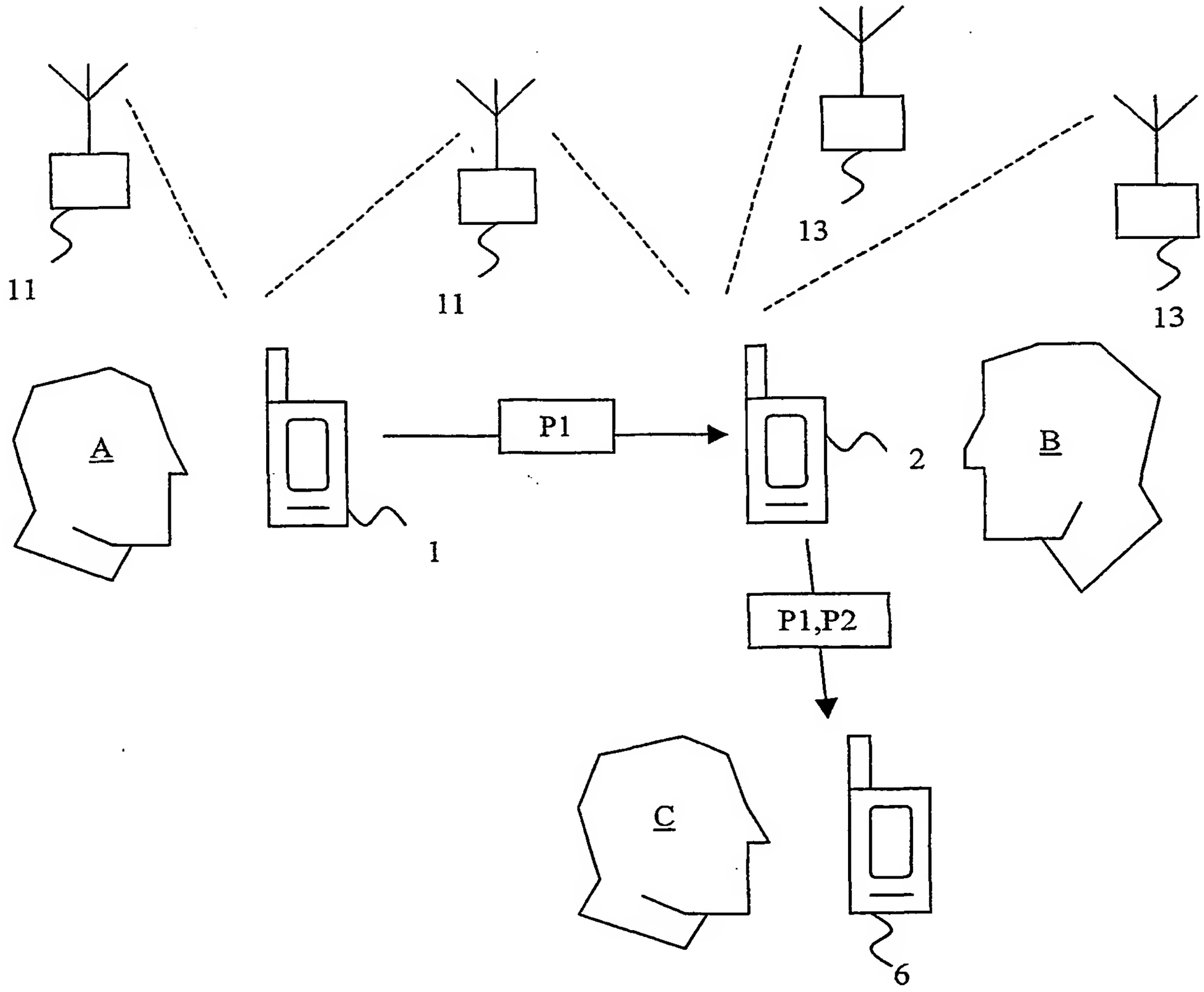

Fig. 3

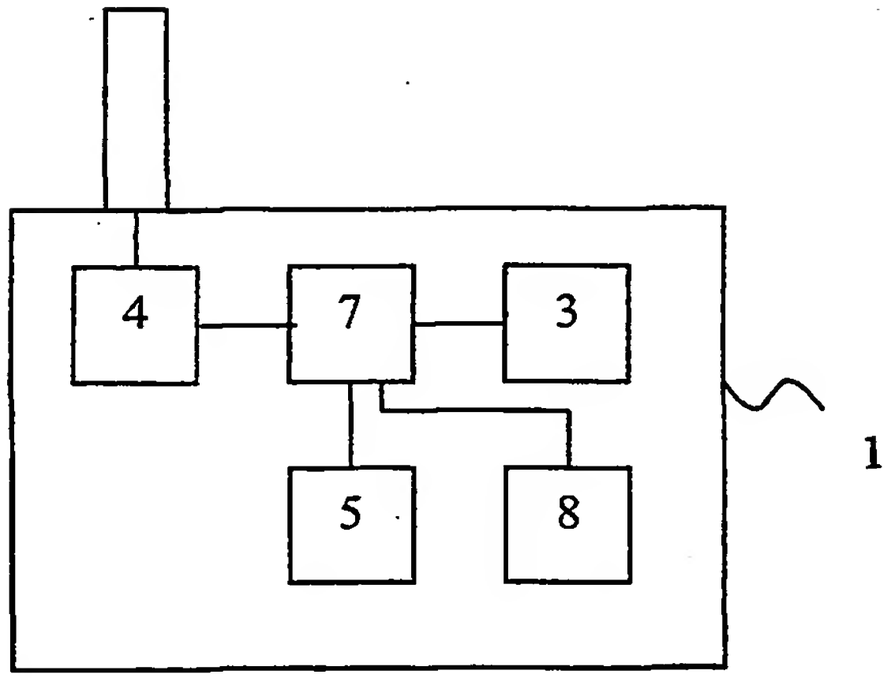

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/00572

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9602007 A1 (LOCKHEED SANDERS, INC), 25 January 1996 (25.01.96), page 1, line 8 - line 13; page 3, line 27 - page 4, line 5; page 4, line 29 - page 5, line 11 --	1-22
A	US 5327144 A (STILP ET AL), 5 July 1994 (05.07.94), abstract --	1-22
A	US 5343493 A (KARIMULLAH), 30 August 1994 (30.08.94), abstract --	1-22

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 June 2002	02 -07- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer STEFAN HANSSON/SN Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

01/05/02

International application No.
PCT/SE 02/00572

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